

- Q1.** (a) Name and outline a mechanism for the reaction of 2-bromo-2-methylpropane with ethanolic potassium hydroxide to form the alkene 2-methylpropene, $(\text{CH}_3)_2\text{C}=\text{CH}_2$

Name of mechanism

Mechanism

(4)

- (b) Two stereoisomers of but-2-ene are formed when 2-bromobutane reacts with ethanolic potassium hydroxide.

- (i) Explain what is meant by the term *stereoisomers*.

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.....

- (ii) Draw the structures and give the names of the **two** stereoisomers of but-2-ene.

Stereoisomer 1

Stereoisomer 2

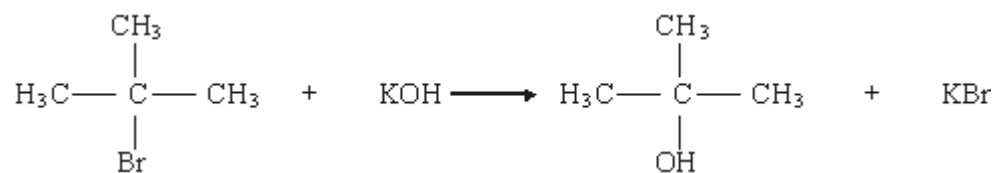
Name *Name*

- (iii) Name this type of stereoisomerism.

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(5)

- (c) When 2-bromo-2-methylpropane reacts with aqueous potassium hydroxide, 2-methylpropan-2-ol is formed as shown by the following equation.



State the role of the hydroxide ions in this reaction.

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(1)

- (d) Write an equation for the reaction that occurs when $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ reacts with an excess of ammonia. Name the organic product of this reaction.

Equation

Name of product

(3)

(Total 13 marks)

Q2. The mechanism for the reaction of methane with fluorine is a free-radical substitution similar to the chlorination of methane.

- (a) Outline the following steps in the mechanism for the reaction of methane with fluorine to form fluoromethane, CH_3F

Initiation step

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First propagation step

.....

Second propagation step

.....

A termination step

.....

(4)

- (b) Write an overall equation for the reaction of fluorine with fluoromethane to form tetrafluoromethane.

.....

(1)

(Total 5 marks)

- Q3.** (a) Bromomethane, CH_3Br , can be formed by a reaction between bromine and methane.

The mechanism for this reaction is similar to the mechanism for the chlorination of methane.

- (i) Name the mechanism for this reaction.

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- (ii) Give the name of, and state an essential condition for, the first step in the mechanism for this reaction.

Name

Essential condition

- (iii) Write an equation for a termination step in the mechanism for this reaction which gives ethane as a product.

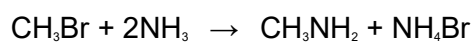
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- (iv) Bromomethane can undergo further substitution. Write an overall equation for the reaction between bromomethane and bromine in which dibromomethane is formed.

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(5)

- (b) Bromomethane reacts with the nucleophile ammonia according to the following equation.



- (i) Explain what is meant by the term *nucleophile*.

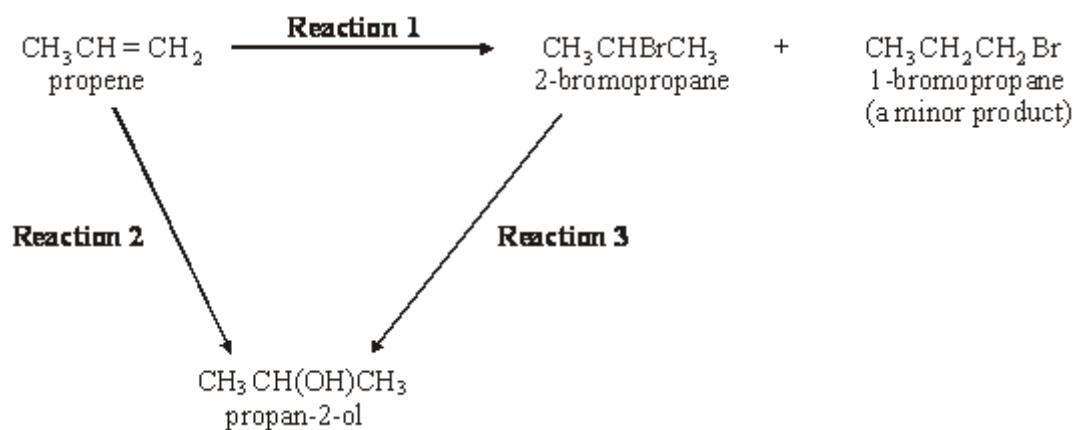
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- (ii) Name the organic product of this reaction.

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- (iii) Outline a mechanism for this reaction.

Q4. Consider the following reaction scheme.



(a) (i) Name the mechanism for **Reaction 1**.

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(ii) Explain why 1-bromopropane is only a minor product in **Reaction 1**.

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.....

(3)

(b) Give a suitable reagent and state the essential conditions required for **Reaction 3**.

Reagent

Conditions

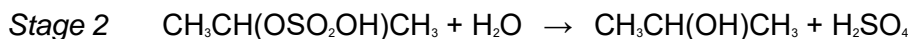
(2)

- (c) The reagent used for **Reaction 3** can also be used to convert 2-bromopropane into propene. State the different conditions needed for this reaction.

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(1)

- (d) **Reaction 2** proceeds in two stages.



- (i) Name the class of alcohols to which propan-2-ol belongs.

.....

- (ii) Outline a mechanism for Stage 1 of **Reaction 2**, using concentrated sulphuric acid.

- (iii) State the overall role of the sulphuric acid in **Reaction 2**.

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(6)

(Total 12 marks)

Q5. (a) Addition reactions to both alkenes and carbonyl compounds can result in the formation of isomeric compounds.

(i) Choose an alkene with molecular formula C_4H_8 which reacts with HBr to form two structural isomers. Give the structures of these two isomers and name the type of structural isomerism shown.

Outline a mechanism for the formation of the major product.

(ii) Using HCN and a suitable carbonyl compound with molecular formula C_3H_6O , outline a mechanism for an addition reaction in which two isomers are produced.
Give the structures of the two isomers formed and state the type of isomerism shown.

(14)

(b) Explain why ethanoyl chloride reacts readily with nucleophiles.
Write an equation for one nucleophilic addition–elimination reaction of ethanoyl chloride.
(A mechanism is not required.)

(4)

(Total 18 marks)